and rapidly along rock faces, and its real evaporating surface soon lies below the actual surface, the upper dry layers acting like a dust mulch. The seedlings send roots downward very rapidly and are slow in developing foliage until the root system is extended deep. The sap of cacti is found to have an osmotic pressure not notably higher than that of many mesophytes; but the gums, etc., in their cells, which do not sensibly raise osmotic pressure, hold back water. An evaporimeter, consisting of an exposed tube of porous porcelain filled with water and connected with a burette, enables ready measurement or automatic record of the effect of atmospheric conditions on evaporation, and by calibration the measurements may be converted into evaporation rate per surface unit of free water. Experiments show that no clue to real facts is given a study of transpiration from plants in a closed chamber,[7] because of the striking effects of air currents. Relative transpiration, i. e., the ratio of evaporation from a plant to evaporation from the same surface of free water, is proposed as the best way of expressing the facts. The highest relative evaporation noted was 0.785 and the lowest 0.008. Observations indicate a "physiological regulation" of transpiration, in which air temperature is apparently the dominant factor.

Throughout, the work shows the purpose of the author to grapple with the problem as a physical one; only here and there a phrase survives, such as "the absorptive power exerted by the plant," that recalls the less modern attitude. Surely it is only by conceiving the plant, the air, and the soil as a system, within which exchanges occur under very definite and definable physical conditions, that we can hope to state these exchanges intelligibly. Why not modify the evaporimeter by putting the foot of its water column into the soil and then try to state the changes within that system? When that can be done, there is hope for plant evaporation, and not till then.—C. R. B.

MINOR NOTICES

Key to woody plants.—In 1904 WIEGAND and FOXWORTHY published a very useful *Key to the genera of woody plants in winter*, including the genera with hardy representatives found growing wild or in cultivation within the state of New York. The first edition was exhausted, and a second one has now appeared.[8] The text has been revised, but not much enlarged, two or three genera have been added, and the keys to the conifers have been considerably expanded.—J. M. C.

Food for plants.—A new edition of a booklet under this title by HARRIS and MYERS is edited and published by WM. S. MYERS, who is now devoting his time and energy to the nitrate of soda propaganda. It goes without saying that the term "food" as used applies to the mineral salts which yield nitrogen and phosphorus. The book is a queer mixture of general information for the curious,

[7] *Cf.* CANNON'S polymeter method, Bull. Torr. Bot. Club **32**:575. 1905.

[8] WIEGAND, K. M., and FOXWORTHY, F. W., A key to the genera of woody plants in winter. Second edition. pp. 33. Ithaca, N. Y.: The authors. 25 cents.

results of experimental cultures, directions for raising various crops with appropriate fertilizers, business maxims, a plea for good roads, etc. It has neither coherence nor apparent object beyond advertising under the guise of a handbook.—C. R. B.

Botanical literature.—Section M of the International Catalogue of Scientific Literature, devoted to botany, was published in July by the Royal Society of London. It contains the literature for 1904, and some belated entries for the preceding three years.[9] The volumes are improving in comprehensiveness and accuracy. Certainly no research laboratory can do without them.—C. R. B.

Volatile oils.—The semi-annual report of SCHIMMEL & Co., dated October-November 1906, contains an unusually extensive statement of the trade conditions respecting the volatile oils and the plants which produce them. Fifty pages also are devoted to a summary of recent researches on terpenes and the terpene derivatives.[10]—C. R. B.

Genera Siphonogamarum.—The ninth fascicle of DALLA TORRE and HARMS[11] list of the genera of seed plants continues the general alphabetical index of names, the last entry being Diplopeltis.—J. M. C.

NOTES FOR STUDENTS

Galvanotropism of roots.—Two studies on this topic appeared almost simultaneously last autumn. SCHELLENBERG investigated the influence of salts on the direction of growth of the roots of peas,[12] using roots of seedlings grown to a length of 3–4^{cm} in moist sawdust and then fixed vertical in very dilute solutions of various salts, with cotyledons exposed. The experimental vessel with the solution was connected by filter-paper bridges with vessels at each side which contained the same solution, and into these were led metallic electrodes with a current of 2–6 volts, and 0.1 to .001 milliampere. Neglecting the effects of stronger currents, which produce curvatures due to death or disturbances of growth, the vast preponderance of response was a turning toward the anode, NH_4Cl alone showing 6 out of 8 curvatures toward the cathode. Chemotropic studies have shown that the reaction changes with concentration; it likewise

[9] International Catalogue of Scientific Literature. Fourth annual issue. M. Botany. Published for the International Council by the Royal Society of London. London: Harrison & Sons. 37*s.* 6*d.*

[10] Semi-annual report of SCHIMMEL & Co. (FRITSCHE BROS.). Miltitz near Leipzig. 12mo. pp. 161. New York: Fritsche Bros. 1906. Free.

[11] DALLA TORRE, C. G. DE, and HARMS, H., Genera Siphonogamarum ad systema Englerianum conscripta. Fasc. 9. pp. 641–720. Leipzig: Wilhelm Englemann. 1907. *M* 6.

[12] SCHELLENBERG, H. C., Untersuchungen über den Einfluss der Salze auf die Wachstumsrichtung der Wurzeln, zunächst an der Erbsenwurzel. Flora **96**:474–500. 1906.